

Balanced and Unbalanced Forces

How do balanced and unbalanced forces affect an object's motion?

What is inertia?

Inertia is the resistance of any physical object to any change in its state of motion, including changes to its speed and direction.

Inertia tells us that we need a **force** to get an object to move or stop an object from moving.

Discuss!

- Did any of the stations demonstrate inertia?

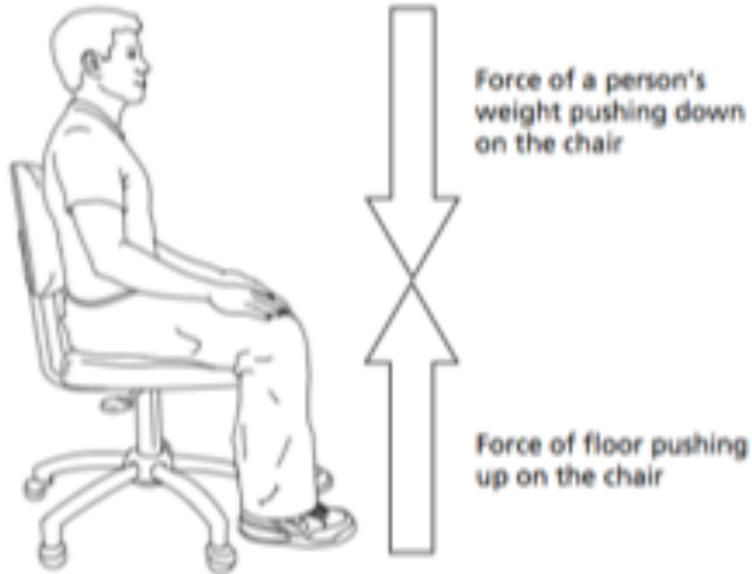
What is a force?

- In science, a force is a **push** or a **pull**.
- All forces have two properties:

Direction and **Size**

- A **newton** (N) is the unit that describes the **size** of a force.

What is a force



A person sitting on a chair.

- The student is **pushing** down on the chair, but the chair does not move.
- The floor is **balancing** the force by pushing on the chair.

Combining Forces

- More than one **force** often acts on an **object**.
- When all the forces acting on an object are **added** together, you determine the **net force** on the object.
- An object with a net force more than **0** N on it will change its state of **motion**.

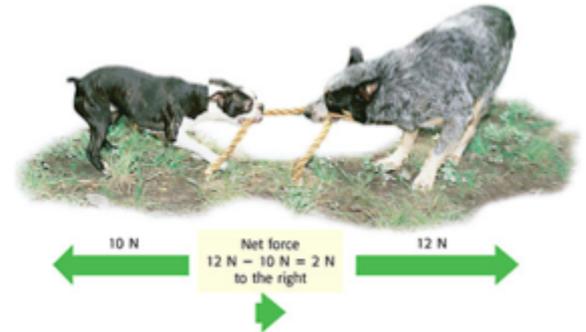
Forces in the Same Direction

- When **forces** are applied in the **same** direction, they are **added** to determine the **size** of the net force.



Forces in Different Directions

- When two forces act in opposite directions, you subtract the smaller force from the larger force to determine the net force.
- The net force will be in the same direction as the larger force.



Balanced Forces

- When the forces on an object produce a net force of **0** N, the forces are **balanced**.
- There is **no change** in the **motion** of the object.

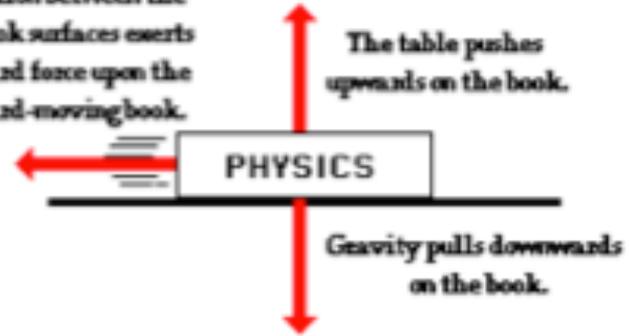


Unbalanced Forces

- When the net force on an object is **not 0 N**, the forces on the object are **unbalanced**.
- Unbalanced forces produce a **change in motion** of an object.

The forces acting on the book are not balanced.

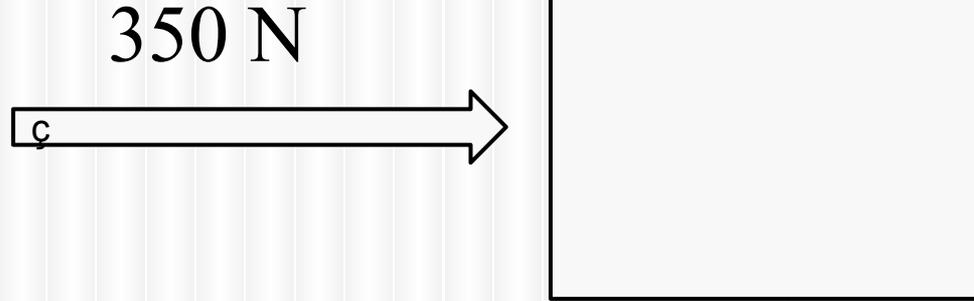
The friction between the table/book surfaces exerts a leftward force upon the rightward-moving book.



The table pushes upwards on the book.

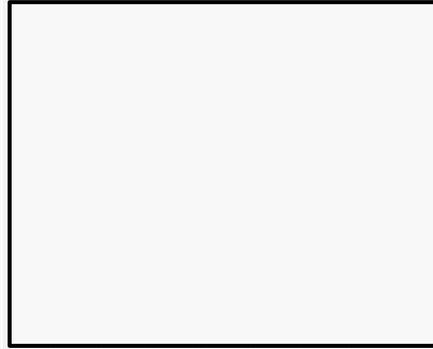
Gravity pulls downwards on the book.

Let's Practice!



Net Force _____

Let's Practice



200 N



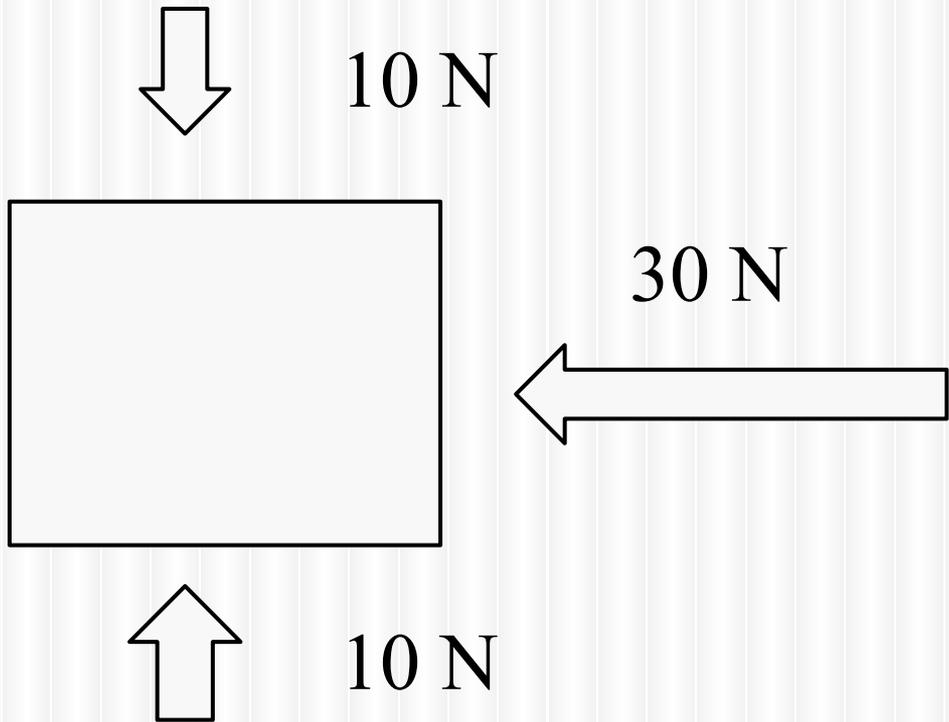
Net Force: _____

Let's Practice



Net Force _____

Let's Practice



Net Force: _____

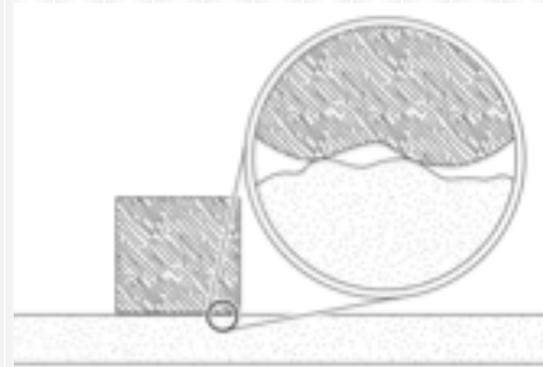
Exploring Forces

We will look at three examples of forces:

- Friction
- Gravity
- Magnets

Friction

- **Friction** is the force that **opposes** the **motion** between two **surfaces** that **touch**.
- The **surface** of any object is **rough**.
- Even an object that feels **smooth** is covered with tiny **hills** and **valleys**.
- The **contact** between the hills of valleys of two surfaces causes them to **stick**, resulting in friction.



Friction

- The amount of friction depends on:
 - Roughness of the surfaces
 - Force pushing the surfaces together

Types of Friction

Kinetic friction occurs when **force** is applied to an object and the object **moves**.

Examples:

Sliding Friction: pushing an object across a surface

Rolling Friction: between wheels and a surface

Fluid Friction: opposes the motion of objects traveling through a fluid (air or water)

Types of Friction

Static friction occurs when force applied to an object does not cause the object to move.



Reducing Friction

- To reduce the amount of friction, apply a lubricant between two surfaces.

Ex) Motor oil, wax, and grease

- Friction can also be reduced by rolling, rather than pushing, an object.

Increasing Friction

- Friction increases when the surface area of an object increases.
- Friction increases as surfaces are made rougher.
- Friction increases when the force between two objects increases.

Discuss!

- How does friction affect an object's movement?
- How can friction be beneficial?
- How can friction be a problem?
- Which stations demonstrated friction at work?

Gravity

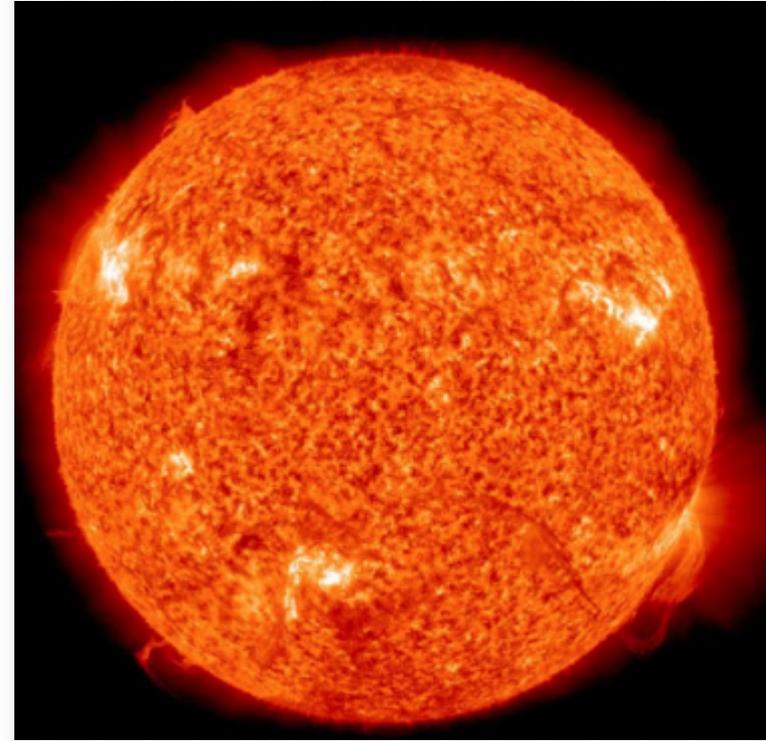
Gravity is the force of attraction between matter.

Gravity depends on:
mass and distance

Mass and Gravity

The more massive an object the more it can attract objects to itself.

For example, the Sun has a larger gravitational effect than the Earth.



Distance and Gravity

The farther
away objects get
from one another,
the less
gravitational
attraction can be
found.

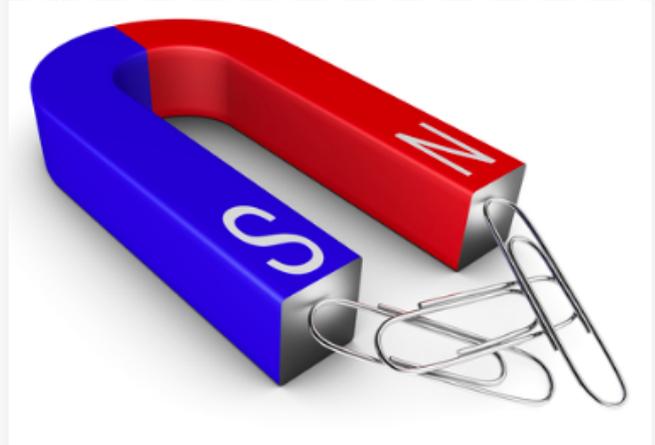


Discuss!

- How does gravity affect an object's motion?
- Is gravity balanced, unbalanced, or both?
Give evidence to support your answer.
- Was gravity at play in any of the stations?

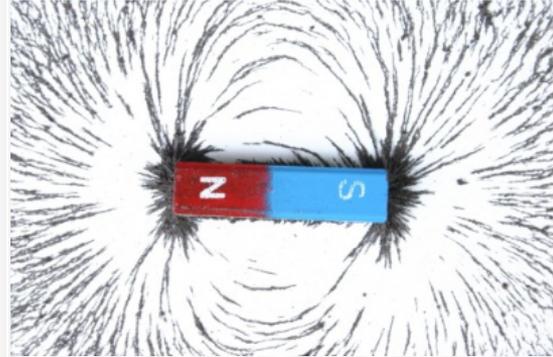
Magnets

A **magnet** is an object with a north and south pole that produces a magnetic field and exerts a magnetic force.



Magnets

A magnetic field is the force field that surrounds the magnet.

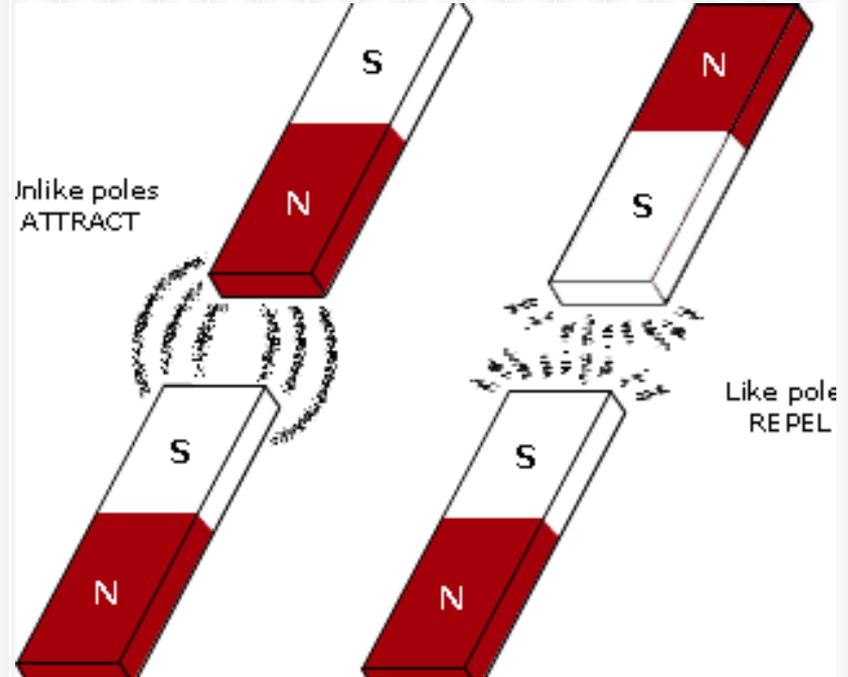


A magnetic force can cause objects to *attract* or *repel* without needing to touch the magnet!

Poles

Like poles will repel or move **away** from one another.

Opposite poles will **attract** or move towards one another.



Compass

A compass uses the Earth's magnetic field and magnets to help a person determine direction. The magnet's poles will line up with the Earth's north magnetic pole and south magnetic pole.



Discuss!

- How do magnets affect an object's motion?
- What happens to an object's motion if no forces are acting on it?